CLAIMS

What is claimed is:

1. Isolated outer membranes containing less than about 0.01% by weight lipooligosaccharide, produced by a method comprising:

    a) extracting total membranes of a Gram-negative coccus with a polyoxyethylene detergent to produce outer membranes depleted of inner membranes; and

    b) extracting the outer membranes produced by step a) with a zwitterionic betaine detergent to produce an insoluble faction containing outer membranes containing less than about 0.01% by weight lipooligosaccharide and a soluble fraction containing lipooligosaccharide; and

    c) recovering the outer membranes from the insoluble fraction produced by step b).

2. Isolated outer membranes of Claim 1, wherein the coccus is *Neisseria*.

3. Isolated outer membranes of Claim 2, wherein the coccus is selected from the group consisting of *Neisseria meningitidis* and *Neisseria gonorrhoeae*.

4. Isolated outer membranes of Claim 1, wherein the coccus is *Moraxella*.

5. Isolated outer membranes of Claim 4, wherein the coccus is *Moraxella catarrhalis*.

6.　Isolated outer membranes of Claim 1, wherein the polyoxyethylene detergent is selected from the group consisting of:

a)　nonaethylene glycol octylphenol ether;

b)　polyoxyethylene(23) lauryl ether; and

c)　polyoxyethylene sorbitan monooleate.

7.　Isolated outer membranes of Claim 1, wherein the zwitterionic betaine detergent has the formula:
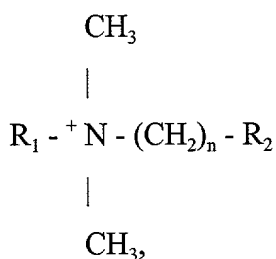
$$CH_3$$
$$|$$
$$R_1 - {}^+N - (CH_2)_n - R_2$$
$$|$$
$$CH_3,$$

where R_1 is an alkyl chain with greater than 10 carbons and less than or equal to 16 carbons, R_2 is a carboxyl group or a sulfonyl group, and n is greater than 1.

8.　Isolated outer membranes of Claim 7, wherein the zwitterionic betaine detergent is selected from the group consisting of:

a)　R_2=a sulfonyl group, n=3 and R_1 is a C12 alkyl group;

b)　R_2=a sulfonyl group, n=3 and R_1 is a C14 alkyl group; and

c)　R_2=a carboxyl group, n=2 and R_1 is a C12 alkyl group.

9.　Isolated outer membranes of Claim 1, wherein step a) of the method is performed more than once before proceeding with step b).
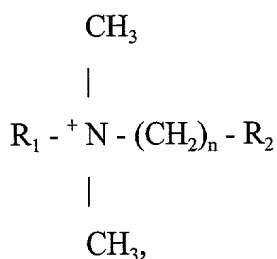
10.　Isolated outer membranes of Claim 1, wherein step b) of the method is performed more than once.

11. Isolated soluble outer membrane proteins containing less than about 0.01% by weight lipooligosaccharide, produced by a method comprising:

    a) extracting total membranes of a Gram-negative coccus with a polyoxyethylene detergent to produce outer membranes depleted of inner membranes;

    b) extracting the outer membranes produced by step a) with a zwitterionic betaine detergent to produce an insoluble fraction containing outer membranes containing less than about 0.01% by weight lipooligosaccharide and a soluble fraction containing lipooligosaccharide;

    c) extracting the insoluble fraction containing outer membranes produced by step b) with a zwitterionic betaine detergent in salt buffer to produce a fraction containing soluble outer membrane proteins and a fraction containing insoluble outer membrane proteins and cell wall components; and

    d) isolating the soluble outer membrane proteins.

12. Isolated soluble outer membrane proteins of Claim 11, wherein the coccus is *Neisseria*.

13. Isolated soluble outer membrane proteins of Claim 12, wherein the coccus is selected from the group consisting of *Neisseria meningitidis* and *Neisseria gonorrhoeae*.

14. Isolated soluble outer membrane proteins of Claim 11, wherein the coccus is *Moraxella*.

15. Isolated soluble outer membrane proteins of Claim 14, wherein the coccus is *Moraxella catarrhalis*.

16. Isolated soluble outer membrane proteins of Claim 11, wherein the polyoxyethylene detergent is selected from the group consisting of:

a) nonaethylene glycol octylphenol ether;

b) polyoxyethylene(23) lauryl ether; and

5   c) polyoxyethylene sorbitan monooleate.

17. Isolated soluble outer membrane proteins of Claim 11, wherein the zwitterionic betaine detergent has the formula:

$$R_1 - {}^+N - (CH_2)_n - R_2$$

with CH_3 groups above and below the N,

where R_1 is an alkyl chain with greater than 10 carbons and less than or equal to 16 carbons, R_2 is a carboxyl group or a sulfonyl group, and n is greater than 1.
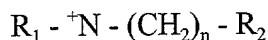
18. Isolated soluble outer membrane proteins of Claim 17, wherein the zwitterionic betaine detergent is selected from the group consisting of:

a) R_2=a sulfonyl group, n=3 and R_1 is a C12 alkyl group;

b) R_2=a sulfonyl group, n=3 and R_1 is a C14 alkyl group; and

20   c) R_2=a carboxyl group, n=2 and R_1 is a C12 alkyl group.

19.   Isolated soluble outer membrane proteins of Claim 11, wherein the
zwitterionic betaine detergent of step (c) has the following formula:

$$CH_3$$

$$R_1 - {}^+N - (CH_2)_n - R_2$$

$$CH_3,$$

wherein R_2 is a sulfonyl group, n is 3 and R_1 is a C14 alkyl group,
and wherein the salt buffer is about 0.1 M to about 0.5 M NaCl.

20.   Isolated soluble outer membrane proteins of Claim 11, wherein the method
further comprises concentrating the soluble outer membrane proteins.

21.   Isolated insoluble outer membrane proteins and cell wall components
containing less than about 0.01% by weight lipooligosaccharide, produced
by a method comprising:

a)   extracting total membranes of a Gram-negative coccus with a
polyoxyethylene detergent to produce outer membranes depleted of
inner membranes;

b)   extracting the outer membranes produced by step a) with a
zwitterionic betaine detergent to produce an insoluble fraction
containing outer membranes containing less than about 0.01% by
weight lipooligosaccharide and a soluble fraction containing
lipooligosaccharide;

c)   extracting the insoluble fraction containing outer membranes
produced by step b) with a zwitterionic betaine detergent in salt
buffer to produce a fraction containing soluble outer membrane
proteins and a fraction containing insoluble outer membrane proteins
and cell wall components; and

d)   isolating the insoluble outer membrane proteins and cell wall
components.

22.   Isolated insoluble outer membrane proteins and cell wall components of Claim 21, wherein the coccus is *Neisseria*.

23.   Isolated insoluble outer membrane proteins and cell wall components of Claim 22, wherein the coccus is selected from the group consisting of *Neisseria meningitidis* and *Neisseria gonorrhoeae*.

24.   Isolated insoluble outer membrane proteins and cell wall components of Claim 21, wherein the coccus is *Moraxella*.

25.   Isolated insoluble outer membrane proteins and cell wall components of Claim 24, wherein the coccus is *Moraxella catarrhalis*.

26.   Isolated insoluble outer membrane proteins and cell wall components of Claim 21, wherein the polyoxyethylene detergent is selected from the group consisting of:
a)   nonaethylene glycol octylphenol ether;
b)   polyoxyethylene(23) lauryl ether; and
c)   polyoxyethylene sorbitan monooleate.

27.   Isolated insoluble outer membrane proteins and cell wall components of Claim 21, wherein the zwitterionic betaine detergent has the formula:
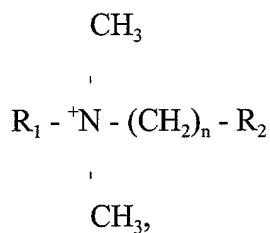
$$R_1 - {}^+N(CH_3)(CH_3) - (CH_2)_n - R_2$$
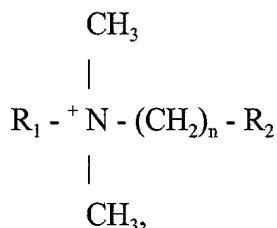
where R_1 is an alkyl chain with greater than 10 carbons and less than or equal to 16 carbons, R_2 is a carboxyl group or a sulfonyl group, and n is greater than 1.

28.   Isolated insoluble outer membrane proteins and cell wall components of Claim 27, wherein the zwitterionic betaine detergent is selected from the group consisting of:

a) R_2=a sulfonyl group, n=3 and R_1 is a C12 alkyl group;

b) R_2=a sulfonyl group, n=3 and R_1 is a C14 alkyl group; and

c) R_2=a carboxyl group, n=2 and R_1 is a C12 alkyl group.

29.   Isolated insoluble outer membrane proteins and cell wall components of Claim 21, wherein the zwitterionic betaine detergent of step (c) has the following formula:

$$CH_3$$
$$|$$
$$R_1 - {}^+N - (CH_2)_n - R_2$$
$$|$$
$$CH_3,$$

wherein R_2 is a sulfonyl group, n is 3 and R_1 is a C14 alkyl group, and wherein the salt buffer is about 0.1 M to about 0.5 M NaCl.